

## Description

# MULTI-FUNCTION PICK-UP CAP FOR ELECTRICAL CONNECTOR

### CROSS REFERENCE TO RELATED APPLICATIONS

[0001] Relevant subject matter is disclosed in pending U.S. Patent Applications entitled "ELECTRICAL CONTACT AND METHOD OF MAKING THE SAME", and entitled "ELECTRICAL CONNECTOR WITH IMPROVED COTANCT RETENTION" filed on June 23, 2003, all of which are invented by the same inventor as this patent application and assigned to the same assignee with this application.

### BACKGROUND OF INVENTION

### FIELD OF THE INVENTION

[0002] The present invention generally relates to an electrical connector, and more particularly to a pick-up cap for an electrical connector.

### DESCRIPTION OF RELATED ART

[0003] Electrical connectors electrically connected to a printed

circuit board often have through hole (T/H) or surface mount type contacts and are preferably placed at selected positions on the printed circuit board by pick-and-place apparatus. U.S. Patent Nos. 5,026,295 and 6,116,949 disclose electrical connectors to which a cover or cap is mounted so that a suction nozzle of a suction apparatus can engage the cover or cap and, via suction pick-up, the electrical connectors and place them onto selected positions of a printed circuit board. The cover or cap is removed from the connectors after the contacts have been soldered to the printed circuit board.

[0004] With the rapid development of economy, high production efficiency is a primary aim of manufacturers all along. However, the electrical connectors disclosed above usually use tools or an operators fingers to insert electrical contacts to housings thereof, and then the cover or cap is assembled to the housings. This wastes time of assembling the connectors to the printed circuit board, thus, decreases the production efficiency. In addition, the cover or cap only engages with the housings of the electrical connectors, and the electrical contacts engage with the housing via retention barbs thereof. Therefore, the electrical contacts still have room to move between the cover or cap

and the housing during being soldered to the printed circuit board. This inevitably influences electrical connection between the connectors and the printed circuit board.

- [0005] Hence, a multi-function pick-up cap is needed to address the problems encountered in the related art.

## **SUMMARY OF INVENTION**

- [0006] An object of the present invention is to provide a multi-function pick-up cap used in an electrical connector for improving production efficiency.
- [0007] Another object of the present invention is to provide an electrical connector assembly with a multi-function pick-up cap for achieving more reliable electrical connection with a printed circuit board.
- [0008] In order to achieve the objects set forth, OLE\_LINK3 an electrical connector assembly in accordance with the present invention comprises an insulative housing, a plurality of contacts received in the insulative housing, and a pick-up cap. Each contact comprises a contacting portion and a connecting portion for being soldered to a printed circuit board. The pick-up cap is removably assembled to the insulative housing and retains and positions the contacts in the insulative housing.
- [0009] Other objects, advantages and novel features of the in-

vention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

## **BRIEF DESCRIPTION OF DRAWINGS**

- [0010] FIG. 1 is a perspective view of an insulative housing of an electrical connector assembly in accordance with the present invention;
- [0011] FIG. 2 is a partially enlarged view of the insulative housing of FIG. 1;
- [0012] FIG. 3 is a perspective view of a plurality of contacts of the electrical connector assembly with a carrier thereon in accordance with the present invention;
- [0013] FIG. 4 is a perspective view of a pick-up cap in accordance with the present invention;;
- [0014] FIG. 5 is a view similar to FIG. 4, but taken from bottom and rear aspects;
- [0015] FIG. 6 is a perspective view illustrating a plurality of contacts with carriers thereon being assembled to the pick-up cap, with solder balls on the contacts being illustrated by broken lines;;
- [0016] FIG. 7 is a view similar to FIG. 6, with the carriers being removed from the contacts and the solder balls on the contacts;

- [0017] FIG. 8 is an assembled view of the electrical connector assembly in accordance with the present invention;
- [0018] FIG. 9 is a partially cross-sectional view of the electrical connector assembly taken along line 9-9 of FIG. 8; and
- [0019] FIG. 10 is a partially cross-sectional view of the insulative housing taken along line 10-10 of FIG. 1, with one contact being assembled therein and illustrated by broken lines.

#### **DETAILED DESCRIPTION**

- [0020] Reference will now be made in detail to the preferred embodiment of the present invention.
- [0021] Referring to FIGS. 8-10, an electrical connector assembly 1 in accordance with the present invention comprises an insulative housing 4, an array of contacts 2 assembled to the insulative housing 4, and a pick-up cap 3.
- [0022] Referring to FIG. 1 and FIG. 2, the insulative housing 4 is of a substantially rectangular box shape and comprises a substantially planar base 40, a pair of longitudinal walls 42 and a pair of lateral walls 43 extending upwardly from periphery of the base 40. A first and a second polarizing tabs 430, 431 are respectively formed on the pair of opposite lateral walls 43 for properly mating with a complementary connector (not shown). A pair of recesses 420 is defined in each longitudinal wall 42. An array of passages

41 extend from a mating surface 400 toward a mounting surface 402 (referring to FIG. 9) of the base 40. A pair of opposite slots 412 is defined in a pair of opposite side surfaces 410 of the passage 41 and communicates with the passage 41. Thus, a step 414 (referring to FIG. 10) is formed in a middle of the passage 41.

[0023] Referring to FIG. 3, each contact 2 comprises a flat contacting portion 21, a connecting portion 23 opposite to the contacting portion 21, and a retention/positioning portion 22 connecting the contacting portion 21 and the connecting portion 23. The retention portion 22 has a smaller width than the contacting portion 21, thus, a pair of shoulders 210 is formed on a rear edge of the contacting portion 21. A plurality of barbs 220 is formed on opposite sides of the retention portion 22. The connecting portion 23 is formed into a solder pad 230 to have a fusible substrate contact mass or body, such as a solder ball 5 (referring to FIG. 7), attached thereon.

[0024] Referring to FIGS. 4–7, the pick-up cap 3 is a substantially rectangular plate and comprises a body portion 30. A first and a second engaging ears 320, 321 are respectively formed on opposite lateral sides 32 of the body portion 30. A pair of claws 310 is formed on each lengthwise side

31 perpendicular to the lateral sides 32. The body portion 30 comprises a smooth upper surface 34 and an opposite lower surface 33. A plurality of ribs 35 protrudes downwardly from the lower surface 33 of the body portion 30 and each has a slot 36 recessed therein.

[0025] Referring to FIGS. 6-10, in assembly, the contacts 2 with carriers 20 integrally formed therewith are assembled to the pick-up cap 3. Upper portions of the contacting portions 21 of the contacts 2 are respectively received in the slots 32 of the pick-up cap 3 and are gripped by the ribs 31. The carriers 20 are then cut away from the contacts 2 (referring to FIG. 7). The solder balls 5 are fused onto the solder pads 230 of the contacts 2. In an alternative embodiment, as shown in FIG. 5, the solder balls 5 can be fused onto the solder pads 230 before the carriers being cut away. The pick-up cap 3 with the contacts 2 are together preloaded to the insulative housing 4. At the time, the pick-up cap 3 with the contacts 2 are only placed on the housing 4. The shoulders 210 of the contacting portion 21 of each contact 2 abut against the steps 414 of a corresponding passage 41. The pick-up cap 3 is then pushed down toward the mounting surface 402 of the insulative housing 4 until the solder pads 230 are substan-

tially coplanar with the mounting surface 402 (referring to FIG. 10). The shoulders 210 of the contacts 2 fit into the inner surfaces 410 of the passages 41. The first and the second engaging ears 320, 321 respectively engage with the first and the second polarizing tabs 430, 431. The claws 310 are respectively received in the recesses 420. Thus, the cap 3 engages with the insulative housing 4 reliably. A vacuum suction apparatus (not shown) engages, the pick-up cap 3 of the electrical connector assembly 1, and via suctioning the pick-up cap 3, places the electrical connector assembly 1 onto selected positions of a printed circuit board (not shown). The cap 3 will not be removed away from the insulative housing 4 until the contacts 2 are soldered to the printed circuit board.

[0026] The pick-up cap 3 in accordance with the present invention not only realizes its original function, but also functions as assembling the contacts 2 to the housing 4 instead of an additional tool. Thus, production efficiency is improved and manufacturing cost is decreased. In addition, the contacts 2 are secured by the pick-up cap 3 during being soldered to the printed circuit board, the contacts 2 have no possibility of moving between the insulative housing 4 and the cap 3. This assures the reliable

electrical connection between the contacts 2 and the printed circuit board. It is understood that because the pick-up cap 3 reliably holds the contacts 2 in position on the printed circuit board during soldering, the contacts 2 and the housing 4 may be arranged in either the relatively fixing manner or the relatively floating manner without jeopardizing soldering.

[0027] It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.